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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ERIK R. ALTMAN, KEMAL EBCIOGLU,
MICHAEL KARL GSCHWIND, and
SUMEDH SATHAYE

Appeal 2008-005359
Application 09/637,078
Technology Center 2100

Decided: August 18, 2009

Before JAY P. LUCAS, THU A. DANG, and CAROLYN D. THOMAS,
Administrative Patent Judges.

DANG, *Administrative Patent Judge.*

DECISION ON APPEAL

I. STATEMENT OF CASE

Appellants appeal the Examiner's final rejection of claims 1, 3-16, 18-30, and 32-40 under 35 U.S.C. § 134(a) (2002). Claims 2, 17, and 31 are canceled. We have jurisdiction under 35 U.S.C. § 6(b) (2002).

We affirm.

A. INVENTION

According to Appellants, the invention provides a method for profiling computer program executions in a computer processing system having a memory hierarchy, whereby profile counts are stored in a memory array for events associated with the computer program executions and the memory array is separate and distinct from the memory hierarchy so as to not perturb normal operations of the memory hierarchy (Spec. 39, ll. 4-12).

B. ILLUSTRATIVE CLAIM

Claim 1 is exemplary and reproduced below:

1. A method for profiling computer program executions in a computer processing system having a processor and a memory hierarchy, comprising the steps of:

executing a computer program;

storing, in a memory array, profile counts for a plurality of events associated with the execution of the computer program, the memory array being separate and distinct from the memory hierarchy so as to not perturb normal operations of the memory hierarchy;

selecting at least one of the plurality of events for profiling;

updating the profile counts for only the selected events;

assisting compilation and optimization of the computer program, based upon the selected profile counts stored in the memory array.

C. REJECTIONS

The prior art relied upon by the Examiner in rejecting the claims on appeal is:

Record	5,355,484	Oct. 11, 1994 (filed Aug. 12, 1991)
Klapproth	5,590,354	Dec. 31, 1996 (filed Jul. 28, 1994)
Krishnaswamy	6,622,300	Sep. 16, 2003 (filed Apr. 21, 1999)

Dictionary of Computing 26, 432 (Oxford Univ. Press, 4th ed. 1996) (hereinafter “Computing”)

Chang, *Using Profile Information to Assist Classic Code Optimizations*, 21(12) Software: Practice and Experience 1301-1321 (Dec. 1991) (hereinafter “Chang”)

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Altman, *DAISY: Dynamic Compilation for 100% Architectural Compatibility*, Proc. of the 24th Annual International Symposium on Computer Architecture (ISCA), 26-37 (June 1997) (hereinafter “Altman”)

Claims 1, 4-8, 11-13, 16, 22, and 38 stand rejected under 35 U.S.C. § 102(e) as anticipated by Krishnaswamy; and, in the alternative, stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy and Klapproth.

Claims 3, 9, 10, 23-30, 32-34, 37, and 39 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy and Computing; and, in the alternative, stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy, Klapproth, and Computing.

Claims 40 and 42 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy and Chang; and, in the alternative, stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy, Klapproth, and Chang.

Claims 14 and 15 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy and Record; and, in the alternative, stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy, Klapproth, and Record.

Claims 18 and 19 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy and Altman; and, in the alternative, stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy, Klapproth, and Altman.

Claims 20 and 21 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy, Altman, and Chang; and, in the alternative, stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy, Klapproth, Altman, and Chang.

Claims 35 and 36 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy, Computing, and Record; and, in the alternative, stand rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy, Klapproth, Computing, and Record.

Claim 41 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy, Chang, and Altman; and, in the alternative, stands rejected under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy, Klapproth, Chang, and Altman.

II. ISSUES

- 1) Have Appellants shown the Examiner erred in finding that Krishnaswamy teaches “selecting at least one of the plurality of events for profiling” (claim 1)?
- 2) Have Appellants shown the Examiner erred in finding that Krishnaswamy teaches “storing, in a memory array, profile counts for a plurality of events associated with the execution of the computer program, the memory array being separate and distinct from the memory hierarchy so as to not perturb normal operations of the memory hierarchy” (claim 1)?

3) Have Appellants shown the Examiner erred in combining Krishnaswamy and Computing in rejecting claims 3, 9-10, 23-30, 32-34, 37, and 39?

4) Have Appellants shown the Examiner erred in combining Krishnaswamy and Chang in rejecting claims 40 and 42?

III. FINDINGS OF FACT

The following Findings of Fact (FF) are shown by a preponderance of the evidence.

Krishnaswamy

1) Profile data is collected via Krishnaswamy's performance monitoring units (PMUs) 90, which are included within CPUs 60 (col. 6, ll. 21-22).

2) A PMU 90 includes multiple counters programmable to count events like: clock cycles; instructions retired; and number of stalls caused by events such as data cache/TLB misses, instruction cache/TLB misses, and pipeline stalls (col. 6, ll. 22-28).

3) The PMUs 90 can include trace buffers that record the history of branches and branch prediction, and addresses that caused cache/TLB misses (col. 6, ll. 28-30).

4) Krishnaswamy illustrates each PMU 90 as separate and distinct from a memory 70 having kernel memory space 100 and user memory space 110 (Fig. 2; col. 4, ll. 27-32).

5) The PMU 90 collection of profile data is nonintrusive and does not significantly degrade processing speed like instrumentation often does (col. 6, ll. 41-45).

Prosecution History

6) An Advisory Action, mailed June 27, 2005, refuses entry of Appellants' supplemental arguments submitted on May 6, 2005, which addressed whether a skilled artisan would have understood Krishnaswamy's PMU 90 to be a "memory array."

7) A reference relied upon by Appellants' arguments – Edwin D. Reilly, Concise Encyclopedia of Computer Science, pp. 504, fig. 1 (2004) – was not entered as part of the appeal record and is not listed by the Evidence Appendix of the Appeal Brief (App. Br. 10 and 29).

Computing

8) Computing defines "scaling" as "[t]he adjustment of values to be used in a computation so that they and their resultant are within the range that can be handled by the process or equipment" (p. 432).

Chang

9) Chang excludes "all basic blocks whose execution count is below a threshold value, e.g. 100 per run, from the trace selection process" and "from the profile-based code optimization" (p. 1308).

IV. PRINCIPLES OF LAW

Claim Interpretation

The *claims* measure the invention. *See SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 1121 (Fed. Cir. 1985) (en banc). “[T]he PTO gives claims their ‘broadest reasonable interpretation.’” *In re Bigio*, 381 F.3d 1320, 1324 (Fed. Cir. 2004) (quoting *In re Hyatt*, 211 F.3d 1367, 1372 (Fed. Cir. 2000)). “Moreover, limitations are not to be read into the claims from the specification.” *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993) (citing *In re Zletz*, 893 F.2d 319, 321 (Fed. Cir. 1989)).

The words of the claim must be given their plain meaning unless the plain meaning is inconsistent with the specification. *Zletz*, 893 F.2d at 321. This is the meaning that the term would have to a person of ordinary skill in the art at the time of the invention, *i.e.*, as of the effective filing date of the patent application. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (*en banc*).

“An intended use or purpose usually will not limit the scope of the claim because such statements usually do no more than define a context in which the invention operates.” *Boehringer Ingelheim Vetmedica, Inc. v. Schering-Plough Corp.*, 320 F.3d 1339, 1345 (Fed. Cir. 2003).

35 U.S.C. § 102

Under 35 U.S.C. § 102, “[a] single prior art reference that discloses, either expressly or inherently, each limitation of a claim invalidates that claim by anticipation.” *Perricone v. Medicis Pharm. Corp.*, 432 F.3d 1368, 1375 (Fed. Cir. 2005) (citation omitted). “Anticipation of a patent claim

requires a finding that the claim at issue ‘reads on’ a prior art reference.”
Atlas Powder Co. v. IRECO, Inc., 190 F.3d 1342, 1346 (Fed Cir. 1999).

35 U.S.C. § 103(a)

Section 103(a) forbids issuance of a patent when “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). In *KSR*, the Supreme Court emphasized “the need for caution in granting a patent based on the combination of elements found in the prior art,” and discussed circumstances in which a patent might be determined to be obvious. *Id.* at 415 (citing *Graham v. John Deere Co.*, 383 U.S. 1, 12 (1966)). The Court reaffirmed principles based on its precedent that “[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *Id.* at 416. The operative question in this “functional approach” is thus “whether the improvement is more than the predictable use of prior art elements according to their established functions.” *Id.* at 417.

New Arguments

“[I]t is inappropriate for appellants to discuss in their reply brief matters not raised in ... the principal brief[]. Reply briefs are to be used to reply to matter[s] raised in the brief of the appellee.” *Kaufman Company v. Lantech, Inc.*, 807 F.2d 970, 973 n.* (Fed. Cir. 1986). “Considering an argument advanced for the first time in a reply brief ... is not only unfair to

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an appellee ... but also entails the risk of an improvident or ill-advised opinion on the legal issues tendered.” *McBride v. Merrell Dow and Pharms., Inc.*, 800 F.2d 1208, 1211 (D.C. Cir. 1986) (internal citations omitted).

V. ANALYSIS

35 U.S.C. § 102

Claims 1, 4-8, 11-13, 16, 22, and 38;

Krishnaswamy

Appellants argue that Krishnaswamy fails to teach or suggest “selecting at least one of the plurality of events for profiling” (claim 1), stating in part:

For example, the counters for Krishnaswamy can be programmed to count events A, B and C. However, that the counters can be programmed to count events A, B and C does not necessarily imply that only A can be selected, or that only A and B can be selected, or any of a variety of combinations for that matter.

(App. Br. 8). Appellants contend that, in view of Krishnaswamy’s alleged failure to teach the “selecting” step of claim 1, Krishnaswamy likewise fails to teach “updating the profile counts for only the selected events” and “compilation and optimization of the computer program, based upon the selected profile counts stored in the memory array” (App. Br. 8-9).

In response, the Examiner finds that “[a]t some point in time a counter is programmed to count an event and as such an event is selected to be

profiled (this is not a statement that the counter will be programmed to select, but instead a statement where the act of programming is the selecting)” (Ex. Ans. 25). Thus, an issue we address on appeal is whether Krishnaswamy teaches “selecting at least one of the plurality of events for profiling” (claim 1).

We begin our analysis by giving the claim its “broadest reasonable interpretation.” *In re Bigio*, 381 F.3d at 1324. Limitations appearing in Appellants’ disclosure, but not recited in the claim, will not be read into the claim. *In re Van Geuns*, 988 F.2d at 1184.

Claim 1 simply does not place any restriction on what the term “selecting” is to be, is to represent, or is to mean other than that “at least one of the plurality of events” is selected “for profiling” (claim 1). We therefore interpret the “selecting” step to be a step of determining a particular event to profile, as defined by the claims.

Krishnaswamy teaches a performance monitoring unit (PMU) that has counters for profiling particular events (FF 2). An artisan would have understood that, to profile particular events, the PMU must necessarily determine which particular events to profile. Thus, the artisan would have understood Krishnaswamy’s PMU to be “selecting at least one of the plurality of events for profiling” (claim 1) because the PMU is programmed to profile the particular events.

As to Appellants contention that Krishnaswamy fails to teach the “updating” and “compilation and optimization” steps (App. Br. 8-9), Appellants do not specify how the language of these further limitations

distinguishes over Krishnaswamy other than reasserting that Krishnaswamy fails to teach the “selecting” step of claim 1 (*Id.*). A statement which merely points out what a claim recites is not an argument for separate patentability of a claim. 37 C.F.R. 41.37(c)(vii).

Appellants further argue that “[c]laim 1 discloses storing profile data in a separate memory so as not to perturb the normal operations of the memory hierarchy” and that “Krishnaswamy only discloses memories that are part of the memory hierarchy” (App. Br. 9-10). Appellants argue that “[m]emory hierarchy, although well known in the art, is defined as registers, cache, main memory, secondary storage (disks), offline storage (tapes),” and cited “Edwin D. Reilly, Concise Encyclopedia of Computer Science, pp. 504, fig. 1 (2004)” for such definition (*Id.*).

The Examiner finds that Krishnaswamy discloses such “storing” step, and responds that “with no support from Appellant’s originally filed disclosure, Appellant now asserts ‘memory hierarchy’ includes, ‘registers, cache, main memory, secondary storage (disks), offline storage (tapes)’” (Ex. Ans. 27).

Thus, an issue we address on appeal is whether Krishnaswamy teaches “storing, in a memory array, profile counts for a plurality of events associated with the execution of the computer program, the memory array being separate and distinct from the memory hierarchy so as to not perturb normal operations of the memory hierarchy” (claim 1).

Claim 1 simply does not place any restriction on what the terms “memory array” and “memory hierarchy” are to be, to represent, or to mean,

but merely recites that the “memory array” stores profile counts and is “separate and distinct from the memory hierarchy so as to not perturb normal operations of the memory hierarchy.” In fact, claim 1 also does not restrict the terms “separate and distinct” other than that the memory array is separate and distinct from the memory hierarchy. That is, the modifying language “so as to not perturb normal operations of the memory hierarchy” does not further limit the scope of the claim, but merely recites the intended use of the memory array, i.e., the context in which it operates. *See Boehringer Ingelheim Vetmedica, Inc.*, 320 F.3d at 1345.

We note that Appellants rely on the Reilly reference to define the “memory hierarchy” as including “registers, cache, main memory, secondary storage (disks), offline storage (tapes).” (App. Br. 10.) However, the Reilly reference was published four years after the time of invention and, thus, does not provide a meaning that a person of ordinary skill would have in the art at the time of the invention. *See Phillips*, 415 F.3d at 1313. Further, the Reilly reference was not entered into the appeal record (FF 7). *See* 37 C.F.R. § 41.37(c)(1)(ix) (“Reference to unentered evidence is not permitted in the brief.”).

Though Appellants contend in the Reply Brief that the “memory array” cannot be formed of counters and must be addressable (Reply Br. 2), the contention was not raised in the Appeal Brief. We will not entertain arguments omitted from the Appeal Brief and raised initially in the Reply Brief. *See Kaufman Co., Inc.*, 807 F.2d at 973 n.*; *McBride*, 800 F.2d at 1210-11. Furthermore, Appellants’ contention relies on arguments denied

entry for appeal (FF 6).

In view of the above, we interpret the “storing” step of claim 1 as merely requiring a “memory array” that stores the recited profile counts and is “separate and distinct” from a “memory hierarchy.”

Krishnaswamy discloses a PMU that counts and records profile events (FF 2-3). The PMU is “included in” a CPU (FF 1), and shown as separate and distinct from Krishnaswamy’s other data storing components (FF 4). We find Krishnaswamy’s PMU, which records profile events, to be a “memory array” that stores profile counts and that is separate and distinct from other data storing components. Thus, we agree with the Examiner that Krishnaswamy teaches “storing, in a memory array, profile counts for a plurality of events associated with the execution of the computer program, the memory array being separate and distinct from the memory hierarchy” as set forth in claim 1.

Furthermore, Krishnaswamy’s PMU “is nonintrusive and does not significantly degrade processing speed” (FF 5). That is, the PMU is not intrusive of other data storing components. Thus, even assuming, *arguendo*, that the language “so as to not perturb normal operations of the memory hierarchy” of claim 1 is not a mere intended use and could be given patentable weight, we would still find that Krishnaswamy’s PMU is “separate and distinct so as not to perturb normal operations” of other data storing components.

For the above reasons, Appellants fail to show the Examiner erred in rejecting claim 1 under 35 U.S.C. § 102(e) as anticipated by Krishnaswamy.

Since Appellants do not provide separate arguments for dependent claims 4-8, 11-13, 16, 22, and 38, Appellants also fail to show the Examiner erred in rejecting those claims under 35 U.S.C. § 102(e) as anticipated by Krishnaswamy. *See* 37 C.F.R. § 41.37(c)(1)(vii). Accordingly, we affirm the rejection of claims 1, 4-8, 11-13, 16, 22, and 38 under 35 U.S.C. § 102(e) as anticipated by Krishnaswamy.

35 U.S.C. §103(a)

Claims 3, 9-10, 23-30, 32-34, 37, and 39;

Krishnaswamy and Computing

Appellants argue that, in view of Krishnaswamy's alleged failure to disclose "selecting at least one of the plurality of events for profiling" (claim 1), Krishnaswamy likewise fails to teach "'a controller adapted to select the events for profiling,' as claimed in claim 23" (App. Br. 14); and "'a controller adapted ... to update the profile counts of the selected events stored in said memory array' and 'wherein the computer processing system assists compilation of the computer program, based upon the profile counts stored in the memory array,' as claimed in claim 23" (App. Br. 14). Other than reasserting that Krishnaswamy fails to disclose "selecting at least one of the plurality of events for profiling" (claim 1), Appellants do not specify how the language of these further limitations distinguishes over Krishnaswamy and Computing. We will not consider a statement which merely points out what a claim recites as an argument for separate patentability of the claim.

Appellants also argue that the Examiner's combining of Krishnaswamy with the concept of scaling of Computing is made "without support" (App. Br. 16). More particularly, Appellants argue that it is "unclear to Appellants how the citation to page 432 of Computing supports the Examiner's statement" and "where such reasoning originated" (*Id.*). The Examiner responds that "Computing demonstrated the concept of scaling in order to ensure variables/results are within range of finite storage equipment" and, further, that it would have therefore been obvious to scale data before writing it to the finite storage (e.g., counters/registers) of Krishnaswamy's PMU (Ex. Ans. 31). Thus, we also address on appeal whether Appellants shown the Examiner erred in combining Krishnaswamy and Computing.

We find the Examiner has clearly articulated the use of a known technique, i.e., scaling as disclosed by Computing, to improve Krishnaswamy's device. Further, Computing demonstrates the use of scaling to ensure variables/results are within range of finite storage equipment (FF 8). An artisan skilled in the art would have found it obvious to use the scaling of Computing to ensure variables/results are within range of finite storage equipment and thus improve Krishnaswamy's device.

Accordingly, for the above reasons, we affirm the rejection of claims 3, 9-10, 23-30, 32-34, 37, and 39 under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy and Dictionary.

Claims 40 and 42;

Krishnaswamy and Chang

As to claims 40 and 42, similar to the rejection of claims 3, 9-10, 23-30, 32-34, 37, and 39, Appellants reassert that Krishnaswamy fails to disclose “selecting at least one of the plurality of events for profiling” of claim 1, from which they depend, but do not specify how the language of these further limitations distinguishes over Krishnaswamy and Chang (App. Br. 17-19). Again, we will not consider a statement which merely points out what a claim recites.

Similarly, Appellants also argue that the combination of Krishnaswamy and Computing is made “without support” (App. Br. 19). More particularly, Appellants argue that “the citation to Chang does not provide any motivation or suggestion [sic] to combine the optimizations of Chang with the PMU counters of Krishnaswamy” (App. Br. 19). The Examiner finds that “Chang demonstrated that it was known at the time of invention to optimize more heavily various parts of a program based upon threshold.” (Ex. Ans. 23). Thus, we also address on appeal whether Appellants have shown the Examiner erred in combining Krishnaswamy and Chang.

We find the Examiner has clearly articulated the use of a known technique, i.e., Chang’s profile-based optimization, to improve Krishnaswamy’s device. An artisan skilled in the art would have found it obvious to combine the optimization of Chang to improve Krishnaswamy’s device.

Accordingly, for the above reasons, we affirm the rejection of claims 40 and 42 under 35 U.S.C. § 103(a) as unpatentable over Krishnaswamy and Chang.

Rejections under Klapproth

All of the rejections under appeal are presented in an alternative form, whereby the claims rejected under Krishnaswamy, alone or in combination with other references, are alternatively rejected under a combined teachings of Krishnaswamy in view of Klapproth, alone or in combination with other references (Ex. Ans. 4, 20, and 21). As discussed above, we find no deficiencies regarding Krishnaswamy. Thus, we also affirm the rejections citing Krishnaswamy in view of Klapproth.

Rejections under Record and Altman

Appellants provide no arguments against the Examiner's findings with respect to Record and Altman, but rather state that all claims rejected under those references "are believed to be patentable by virtue of their dependence from their base claims" (App. Br. 21). In view of the above findings, we affirm the rejections citing Record and Altman.

VI. CONCLUSIONS

(1) Appellants have not shown the Examiner erred in finding that Krishnaswamy teaches "selecting at least one of the plurality of events for profiling" (claim 1).

(2) Appellants have not shown the Examiner erred in finding that Krishnaswamy teaches "storing, in a memory array, profile counts for a

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plurality of events associated with the execution of the computer program, the memory array being separate and distinct from the memory hierarchy so as to not perturb normal operations of the memory hierarchy” (claim 1).

(3) Appellants have not shown the Examiner erred in combining Krishnaswamy and Computing.

(4) Appellants have not shown the Examiner erred in combining Krishnaswamy and Chang.

(5) Claims 1, 3-16, 18-30, and 32-40 are not patentable over the prior art of record.

VII. DECISION

The Examiner’s decision rejecting claims 1, 3-16, 18-30, and 32-40 under 35 U.S.C. § 102(e) and § 103(a) is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

peb

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